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ABSTRACT

In planning educational research, recognition needs to be made of five domains of learning: (1) motor skills, (2) verbal information, (3) intellectual skills, (4) cognitive strategies, and (5) attitudes. In being cognizant of these domains, the researcher is able to distinguish the parts of a content area which are subject to different instructional treatment. He becomes better able to relate the instructional procedures of one subject to those of another. Also, in identifying domains of learning, he recognizes that each requires different techniques for assessment of learning outcomes. Although the five domains are the primary categories which limit the generalizability of conclusions about the learning process, other very obvious characteristics impose limitations as well. Sex and race have been extensively analyzed as have environmental and cultural differences. Age deserves further consideration to show not only what the differences in learning are but why they may be expected to occur. Because the process of learning for a student at one age is likely to be very different from that of a student of another age, differential plans for different ages becomes of critical importance. Clear thinking about the process of learning will be enhanced when researchers recognize necessary distinctions about learning that define the limits within which generalizations can and should be made. (WY)

Domains of Learning

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(President's Address, AERA, February 7, 1971)

Those who profess to study and improve education through methods of research are inevitably concerned with the human activity of learning. It is, after all, the capacity of human beings to learn that makes it possible, and also necessary, for a society to have a set of institutions devoted to education. Educational research may, of course, concern itself rather directly with human learning activity, as is done when one investigates methods of instruction, modes of communication, or procedures for reinforcing the learner's behavior. Or, it may be related to the activity of learning in a somewhat less direct way, as when the focus of investigation is the institutions established to bring about learning, the government and social structure of these institutions, the financing of them, the functions they serve within society as a whole. Wherever the investigation fits along this broad spectrum, there can be little doubt that it is in some manner ultimately to be related to the question of how human beings learn.

From a dictionary, one can identify two primary meanings for the word "learning." Definition one is "the process of acquiring modifications in existing knowledge, skills, habits, or action tendencies." The second definition is "knowledge or skill which is acquired by instruction or study."

It is easy enough to identify domains of learning in its second meaning. We do this all the time when we speak of divisions of the curriculum--knowledge about history, society, biology, literature; and skills of language and mathematics. Such domains have been identified in a variety of ways in different periods. The referent is the content of learning.

What about the first meaning--the process of learning? Are there also domains of learning processes which need to be distinguished, or is it always a single process, to be classified only in terms of its second meaning--the domains of knowledge and skill within which learning occurs? For many years, it would appear, those who conducted research on the learning process proceeded more or less on the assumption that they were searching for a common set of characteristics of the learning process, which would apply whether the learner was engaged in learning to lace a shoe, to define a new word, or to write an essay.

While all this research on the learning process was proceeding, however, those who had to deal in a practical way with such things as curriculum and methods of instruction were finding the absence of domains of the learning process hard to live with. Accordingly, they invented what seems to be a bewildering variety of terms to differentiate such classes of learning, in order to make it possible to think about such matters more clearly. Such phrases as "cognitive learning," "rote learning," "discovery learning," "concrete vs. symbolic learning," "affective learning," "conceptual learning," and many others, are examples of this very strong and demanding tendency.

Each of these categories is useful, of course. However, it also appears that their usefulness is limited--they are not as generally useful as they ought to be. One can readily find examples, for instance, in which learning may be called "rote" in one situation, "conceptual" or "cognitive" in another. Many human performances which may be described as "motor" from one point of view, turn out to be highly "symbolic" in some other sense. The domains that have been identified for the process of learning are limited in usefulness because they are not distinct and mutually exclusive.

Yet another solution to the problem of domains of the learning process was proposed, and appears still to be prevalent in some quarters. This was the suggestion that process domains be simply equated with content domains, resulting in such categories as "language learning," "mathematics learning," or "science learning." Such a solution implies that when one studies the process of learning a language, he cannot thereby gain any significant knowledge about learning mathematics or learning science. Unfortunately for this notion, it is simply not plausible that the human mind works this way. Every added example of the generalizability of findings about the conditions of learning, say, in mathematics, to the conditions of learning which obtain in social studies or science, becomes an instance of the lack of utility of this narrow conception of domains of the learning process.

Fifteen years ago it was possible for me and a collaborator to write a textbook which was basically compatible with the point of view that no need exists for the distinction of domains of the learning process. The results of

learning research could be interpreted as revealing a few "general" principles, such as contiguity and reinforcement, which could be applied as well to tying a shoelace and to writing an essay, and in essentially similar ways. The process of learning was one and the same, regardless of what was being learned. My perception is that a great deal has happened to learning research and learning theory during these fifteen years. Domains of learning have in fact been distinguished, and are being distinguished, by increasingly analytic approaches to the study of human learning as a natural phenomenon. Of course, it is still possible for a learning researcher today to assert his faith that in some fundamental sense all learning will ultimately be found to depend upon the same fundamental processes. In practice, however, he is vastly more aware of the limitations of his findings, in the sense of their generalizability within specified domains.

The Need for Domains of the Learning Process

Why should the educational researcher be cognizant of domains of the process of learning? What need do they fulfill? What functions do they serve?

First, they are needed to distinguish the parts of a content area which are subject to different instructional treatments. The learning of science is not simply "science learning," and the learning of language is not just "language learning." Consider the learning of a foreign language as an example. One part of instruction must typically be concerned with the pronunciation of letters in words. The German word Gemütlichkeit, in order to be understood by a hearer, must be said with the proper sound for the umlauted u, and for the

letter combinations ch and ei--sounds which the student whose native language is English is not used to making. In order to learn to make them, he needs a good deal of practice on these specific letter combinations, as they occur in various words. But what about another part of his foreign language learning--in which he must learn to respond to a German question with a German answer? Is the way to accomplish this to "practice" a set of German answers? Of course this is not so, and no teacher of German would imagine that it is so. There are, then, different parts to this single subject, which need to be differentially handled, so far as instruction is concerned. How shall one describe the different domains of the learning process which apply to the parts of this subject, as they do to the parts of other content areas?

A second need for distinctive domains of the learning process is that of relating the instructional procedures of one subject to those of another. If it is true that one cannot generalize about learning conditions from one part of a subject to another, is it nevertheless also true that similar parts can be found among different content areas? The existence of these comparable parts of different subjects is rather easy to demonstrate. Think of what a student is being asked to learn in mathematics, say, when one asks him to learn to answer the question "What is a triangle?" We expect that he will be able to define this concept, perhaps by using his own words, but better still, by showing how such a figure possesses characteristics of a closed curve and intersections of line segments. Suppose instead the subject is social science, and we want the student to answer the question, "What is a

city?" In an entirely comparable way, we expect that he will be able to demonstate a definition of this concept, by showing that a city possesses the characteristics of concentration of population, commerce, and transportation center. In both these subjects, very different in content, we are dealing with the use of a definition, and similar mental activities would be required in any other subject field. In other words, one of the kinds of things students are asked to learn is using definitions, and this is true whether we are dealing with mathematics, foreign language, science, or whatever.

A third reason for identifying domains of learning is that they require different techniques of assessment of learning outcomes. One cannot use a single way of measuring what has been learned. This is, of course, the basic point made by the pioneering work of Bloom ( ) and Krathwohl ( ) and their associates. As this work amply demonstrates, one cannot expect to employ the same kind of test item, or question, to determine whether a student has learned an item of knowledge, on the one hand, or the ability to synthesize several different ideas, on the other hand. Again, different categories of the learning domain are needed for measurement, regardless of the particular subject matter. They are needed in order to avoid the serious error of assuming that if a student knows "something" about a topic, that he therefore is part of the way to knowing all he needs to know about that topic. Instead, he can learn many more "somethings" without ever accomplishing the latter goal; this is because he needs to undertake entirely different categories of

learning, rather than "more of the same." The ways used to measure these different categories are different, and it is these ways that demonstrate how distinct the mental processes are.

Learning Domains

There are, then, a number of reasons for trying to differentiate domains of the learning process which are orthogonal to "content," but which at the same time are in opposition to the notion that all learning is the same. From the standpoint of an educational researcher, the search is for domains within which generalizations of findings can be made. If the researcher has obtained a result which shows certain conditions to be facilitative of learning, he needs to know, how widely can this result be generalized? Does it apply across subject-matter, across age levels, across classrooms? It is this kind of research utilization question to which the differentiation of domains of learning may be most relevant.

I should like here to summarize my conclusions about the desirable distinctions of domains of learning, which I have written about elsewhere (Gagné, 1970), before going on to discuss their implications for other kinds of distinctions applicable to the learning process. The domains I would distinguish are five, and I call them (1) motor skills; (2) verbal information; (3) intellectual skills; (4) cognitive strategies; and (5) attitudes.

1. Motor skills is a good category to begin with, because it is so generally recognized to be distinctive. These are the capabilities that mediate organized motor performances like tying shoelaces, printing letters, pronouncin

letter sounds, using tools and instruments. As everyone knows, learning motor skills takes practice, in the sense of repetition of the essential motor act. This requirement, in fact, is one of the main characteristics that distinguish motor skills from other domains of learning. It is not at all apparent that other kinds of learning do require practice, at least in the same sense.

2. Verbal information is a second category, surely of enormous importance for the schools. Facts, principles, generalizations, constitute a large portion of any curriculum, in most subjects. Such information is needed in a specific sense for continued learning within a particular subject area. Larger, organized bodies of information are usually called knowledge, and we recognize that people must acquire knowledge not only for further learning within a subject area, but for the lifetime purposes of learning across areas, and for thinking in a very general sense. Notice that the learning process for verbal information is quite different from that of motor skills. Despite the prior persistence of the methodology of the memory drum, the learning of verbal information does not require practice. What it does require is an organized, meaningful context, of the general sort described by Ausubel (1968). Much verbal information--perhaps most--must surely be learned in a single trial, when these other conditions are present.

3. Intellectual skills is the third category I would propose, and I have written about these extensively (Gagné, 1970). They are, most importantly, the discriminations, concepts, and rules that constitute the basic skills of the elementary curriculum, and all of the elaborations of these that occur

throughout more advanced subjects. It seems particularly important to distinguish these from verbal information and knowledge. For example, being able to recall and reinstate a definition verbally is quite different from showing that one can use that definition. The latter is what is meant by an intellectual skill, but not the former. Do intellectual skills require practice for their learning? The evidence does not show that practice, in the usual sense of that term, improves them. Does their learning require an organized, meaningful context? This is doubtful, at least, if one attempts to define meaningful context in the same sense as that required for learning verbal knowledge. Most importantly, the learning of intellectual skills appears to require prior learning of prerequisite skills, in a manner that is surely not true for learning verbal information. For these various reasons, it seems essential to consider them a domain of learning quite distinct from others.

4. A fourth category is cognitive strategies, a domain which has been particularly emphasized by Bruner ( ). In a sense these are also skills, and they are obviously different from verbal knowledge. They are internally organized skills which govern the individual's behavior in learning, remembering, and thinking. Since they are directed toward "self-management" (cf. Skinner, 1968) of learning and thinking, they are obviously different from intellectual skills, which have an orientation toward the learner's environment. Although they are obviously very different from motor skills, curiously enough they share with them the property of deriving their learned organization

from stimuli that arise within the learner. For this reason, they also require a kind of "practice." The word is used here, though, mainly to emphasize the analogy; what appears to be required is repeated occasions in which challenges to thinking are presented. It is notable, therefore, that "thinking strategies" are not learned all at once, as intellectual skills may be. Instead, they exhibit continued refinement as the learner continues to encounter situations in which he has to learn, to remember, to solve problems, and to define problems for himself.

5. Attitudes constitute the fifth domain of learning. Their learning is obviously different from the other categories. They are not learned by practice. They are by no means dependably affected by a meaningful verbal context, as many studies have shown. One of the most effective ways of changing attitudes would appear to be by means of the human model, and the "vicarious reinforcement" described by Bandura (1969). In any case, the human involvement in the process of modifying attitudes makes this kind of learning highly distinctive and different in many respects from the other varieties.

Generalizability and the Domains of Learning

The suggestion I make, therefore, is that when one deals with learning as a process, rather than as a set of content areas, one needs to distinguish the five domains of motor skills, verbal information, intellectual skills, cognitive strategies, and attitudes. These domains set the primary limits on generalizability of research findings concerned with learning. One can

generalize within these areas, regardless of subject matter, with a fair degree of confidence. In contrast, generalising across these domains is at best a highly risky business, and likely to be quite invalid.

Specifically, when one obtains a research finding about how the process of learning or remembering may be facilitated in one of these domains, it is not likely to be applicable, without specific evidence, in another domain.

When one designs a set of learning experiences for one of these domains, like verbal information, they are unlikely to be effective for another domain, like attitudes or cognitive strategies. The reverse is also true.

When one undertakes to measure the outcomes of learning in one of these domains, say, intellectual skills, the method employed is unlikely to work in another domain, such as verbal information or cognitive strategies.

When one attempts to determine the usefulness of audio-visual media for instruction, the manner of employment of the medium in one of these domains is unlikely to be best for another of the domains.

Finally, when one attempts to consider the balance and articulation of the entire curriculum, it is these domains that provide the most useful categories to think about. Is there a concern that some portion of the curriculum is "loaded" with verbal information? Then one had best decide which of the other four domains needs greater emphasis. Otherwise, one is likely to end up merely substituting one set of verbal information for another.

When I assert that these five domains--motor skills, verbal information, intellectual skills, cognitive strategies, and attitudes--are the primary

categories which limit the generalizability of conclusions about the learning process, am I not overlooking some other very obvious human characteristics which might even more clearly impose such limitations? What about sex? Is the learning process in men the same as that in women? What about race? What about age?

Concerning sex and race, it is not my intention to discuss them here as variables which determine differences in the learning process. I think it is unlikely that they are the kinds of variables which biologically limit the generalizability of propositions about learning, although environmental and cultural differences do have this effect, as is shown by a great deal of evidence. The variable of age, however, is a good one to consider further, since it may serve to show not only what the differences in learning are, but why they may be expected to occur.

Age and Learning

Let us consider two students, both of whom are attending school. One is ten years old, in the fourth grade; the other is twenty-four years old, and attending graduate school. Is there a difference in the way they learn?

First of all, there are obvious differences in the arrangements made for their instruction. The fourth-grader is learning how to use his language, in speaking, reading, and writing. He is learning to use mathematical concepts and to solve quantitative problems. Perhaps he is learning also about different nations and cultures of the world. Many of these things to be learned are prescribed as part of a school curriculum. The graduate student may also

have some prescribed subjects to deal with--foreign languages, or statistics, or computer usage. But much of what he learns is determined by him, because he sees the need to learn it--the knowledge of how a specialized field is conceptually organized, of its methods, and its ways of formulating and solving problems.

There are, then, some differences in the kinds of choices that the learner makes, in these two cases, and in the kinds of objectives being pursued, although perhaps not major ones. The ten-year-old is learning how to do some arithmetic, the twenty-four year old is learning how to do some statistics. The ten-year old may have a choice of a South American country whose culture he wishes to explore; the twenty-four year old chooses a particular field of research whose findings he wishes to organize. But how do they go about their learning? Are there differences here?

There are, and they are quite striking ones. In the case of the arithmetic, for example, the fourth-grader is responding to a carefully organized plan of instruction, which provides him with illustrations, a rationale or verbal explanation, some chosen examples, and a means for him to check his operations at frequent intervals. He responds to printed text, to some pictorial presentation, and to the oral communications of the teacher. Arrangements are made for spaced reviews, and for application of the principles he learns in a number of verbally-described situations. In the case of the statistics, the graduate student meets quite a different set of circumstances. Mainly, he is expected to learn by reading a book chapter by chapter, by following

its terse rationale, and by applying what he has learned to problems containing detailed quantitative data. The book does not provide him with many pictorial aids, nor does it furnish lengthy explanations of procedural steps.

Similar contrasts exist in the learning about a foreign country's culture by the fourth-grader, and the learning of the substance of a field of research by the graduate student. The ten-year-old learns the features of a foreign culture when they are carefully embedded within a meaningful context which he learns about partly by reading, partly by using audio-visual aids, partly by the teacher's oral communications. Sometimes, in fact, this meaningful context becomes so rich that it is difficult to tell what he is supposed to be learning. The graduate student, in contrast, does a great part of his learning by reading articles in professional journals or technical books. They seldom can include a meaningful context or background, since that would require too many pages, and they seldom include diagrams or other pictorial aids, since they cost too much. The sentences and paragraphs he reads tend to be long and densely written, and they refer to many abstract and technical concepts.

Both of these provide examples of learning, and both may be effective learning. Yet if one were to study what made learning effective in the ten-year-old, would one be able to generalize to the twenty-four-year old? I think not. The difference in the two instances is often summarized by saying that the twenty-four year old has become to a large extent a <u>self-learner</u>, whereas the ten-year-old has not yet achieved this state, and has a ways to go before he does.

What might "being a self-learner" mean? What does the graduate student bring to his learning task which differs from what is brought by the fourth grader? It seems to me that this question can best be answered in terms of the five domains of learning I have described.

The twenty-four year old has acquired much complex, highly organized verbal knowledge in his field of study. Accordingly, he is able to supply the meaningful organization required when he reads the journal article that is so concisely written. The ten-year old has no such store of verbal information about the cultures of foreign countries, or even perhaps about his own country. The meaningful organization he can bring to bear on the learning task is therefore meager, and we must take a variety of means to supply it for him.

The twenty-four year old has some highly relevant intellectual skills that he has used many times, in approaching the study of statistics. He can perform mixed arithmetic operations, interpret graphs and tables, state and solve proportions, use the concepts of area and of limits. In the case of the ten-year-old, one is not so sure he can recall the prerequisite skills to the new operations he is learning in arithmetic. One therefore takes care to arrange the situation so that these intellectual skills are recalled, and also attempts to insure by means of spaced reviews that the new ones he learns will be readily available in the future. Another kind of difference in intellectual skills is exhibted in language usage. The graduate student is able to respond appropriately to the compact and complicated sentences of text he encounters in his reading, whereas the fourth grader would be confused by these.

The twenty-four year old brings to his learning task some highly valuable cognitive strategies that the ten-year-old has not yet acquired. The former is probably able to sort out main and subordinate ideas in his attending and in his reading. He may well have some techniques of rehearsal which act in the storage of what is learned, as well as efficient strategies for retrieval of previously learned knowledge and skills. And he almost surely has acquired and refined some ways of approaching problems, defining problems, and weighing alternative solutions to problems, that are available only in a primitive form to the ten-year-old.

In terms of these domains alone, there are likely to be enormous differences in the process of learning in the ten-year-old and the twenty-four-year-old individual. These differences exist, not simply because the passage of time has produced a disparity of 14 years in their ages or stage of biological growth and decay. They exist because of a history of learning, which has left in the older person a residue of increased knowledge, a greater repertoire of intellectual skills, a greatly enhanced collection of cognitive strategies, and quite probably a different set of attitudes. All of these capabilities are different in the two instances, and each of them is bound to affect the process of learning, so that it presents a very different problem for instruction for these two individuals.

Is it possible that I have distorted these differences by choosing a graduate student as the twenty-four year old, rather than an adult who is a high school graduate? The differences may be magnified, surely, but not distorted. If one equates inherent intellectual capacity, the typical adult is likely to outdo

the ten-year-old in amount of verbal information he has, either in general or specialized fields. He is very likely to have more powerful cognitive strategies, particularly as these relate to his capabilities of problem-solving and thinking. As for his intellectual skills, these are most likely to display a very uneven picture, since they can rather readily be forgotten unless they are used constantly. For example, unless there are occasions for use in the intervening years, such an adult may well have forgotten how to add fractions, or to find a square root, or to edit written sentences to make verbs agree with subjects. It would not be surprising, therefore, to find a number of specific instances of knowledge or intellectual skill in which the fourth-grader displayed greater capabilities than the young adult. Such instances, however, merely serve to verify the general proposition that the five categories I have described represent the critical dimensions of domains of learning within which generalization is possible. It is of little use to know that some fourth-graders know how to do some things that some adults do not. This is not at all a remarkable fact. But it is of use to know, particularly if one is designing adult education, the nature of the adult's capabilities in the different domains of learning.

Some Implications of Age Differences in Learning Domains

Suppose, then, that generalizations about learning are typically not possible across ages, and for the reasons I have given. It is possible to point out a couple of implications to which one is led by this view of learning processes.

1. The design of college and university instruction is not a good model for the design of instruction for the fourth grade. It sometimes seems to me that when university scholars attempt to design learning exercises for the lower grades they readily fall into this trap. While I can understand how it happens, this does not prevent me from asserting that it is a bad mistake to make. A laboratory exercise in college chemistry, for example, cannot be made into a suitable learning experience for a child, simply by the employment of a carefully phrased verbal explanation. It is not the mere understanding of words which makes the difference between the learning of a child and the learning of a college student. There are of course differences in verbal information specific to the exercise, but these can more readily be brought into approximate equality than can other capabilities. One should expect large differences in the domains of intellectual skills and cognitive strategies. These are by no means so easy to equate, and certainly cannot be made equivalent by providing verbal explanations. These are capabilities that must be learned; if one sets out to teach them to the fourth-grader, it is likely to take some time, and possibly even years of time.

2. A second implication is the reverse of the first: the design of instruction for the ten-year-old is not a good model for college instruction. The idea that these two ought to be alike sometimes crops up in discussions of teacher education. If the person intends to be an elementary teacher, shouldn't good methods best be demonstrated to him by designing his own instruction along the same lines? Shouldn't the instruction of the college student contain the

same kinds of explanations of objectives, the same kinds of questions, the same kinds of discoveries, as one expects him to employ as a teacher in giving instruction to the ten-year-old? This is an extremely wrong-headed notion. The college student, in terms of the learning domains I have described, brings to his instruction a great variety of knowledge, intellectual skills, cognitive strategies and attitudes that the ten-year-old simply doesn't have. If one attempts to design instruction for the college student which assumes that these capabilities are not there, it will surely be perceived as both boring and ridiculous by the college student. Further, if one persists in following the same instructional model by making revisions, the result runs the danger of being badly designed for both age groups. What is needed instead is a clear recognition of different instruction for the fourth-grader and for the college student, based upon expected differences in the different domains of learning. Those who are learning to teach fourth-graders need to become aware of what ten-year-olds are like, not what they themselves are like.

Summary

In conducting educational research and development, one inevitably comes in contact, directly or indirectly, with questions about learning. Some researchers study the process of learning; many others must interpret the findings of such studies, or of less formal observations, in designing instruction, in planning curricula, in constructing lessons, in scheduling school activities.

We are all used to the idea of applying knowledge of the content of learning differentially. We know we must make different plans and designs for instruction in the subject-matters of history, science, mathematics, language, and so on. But how must we proceed in planning for the process of learning? I believe we must recognize and take full account of the different requirements implied by the different domains of learning I have mentioned: motor skills, verbal knowledge, intellectual skills, cognitive strategies, and attitudes. It seems to me that generalizing across these domains is likely to be incorrect, and is at least extremely risky; generalizing within them is not only valid, but needs to be pursued more vigorously than is currently the case.

Are we intrigued by the idea that learning can be stimulated by certain kinds of teacher questioning? Before we go far with this idea, we need to ask, to what domain or domains of learning does it apply?

Are we led to entertain the idea, from some studies of learning, that repetition is ineffective? Here again, the question is, to what domain does this apply?

I have used the variable of age in the attempt to illustrate why it is important to make careful distinctions about the domains of learning. The process of learning for one age is likely to be very different from that of another age. But this is so, not simply because of sheer differences in the passage of time, or the occurrence of physical growth. The child and the older child, the child and the adult, differ primarily because of enormous differences in what they have learned. We must make different arrangements for their learning because

they differ in the knowledge, in the intellectual skills, in the cognitive strategies, and in the attitudes, that they bring to any new learning task.

Age differences, then, are not in themselves a sound basis on which to plan instruction. Yet differential plans for different ages are of critical importance. The basis must be sought instead in the requirements of learning for five different domains. Distinctions among these domains carry implications for the arrangement of instruction, the design of teaching methods, the use of media, and the means employed to assess outcomes.

Perhaps nothing is so intensely and continuously needed in approaching educational problems than clear thinking. I believe that clear thinking about the process of learning will be enhanced when all of us learn to recognize the necessary distinctions about learning that tell us the limits within which generalizations can and should be made. This is the purpose of the distinctions I have described--the domains of learning.